My interest in laboratory research began when I was 14. I enrolled in Authentic Scientific Research, an independent research program offered by my high school. This commitment involved three years of supervised original scientific research, presentations at symposia, and participation in local and national competitions. As part of the requirements for this course I began working during the summers for Dr. XXX at the Marine Biological Laboratory (Woods Hole, MA), where I focused on growth strategies for juvenile toadfish. Mature toadfish are valuable models for the vestibular system and have even been sent into space by NASA to study the effects of microgravity on balance. However, the fish must first grow to a certain size, which takes many years. I developed a strategy to introduce pellet food, a nutritional supplement, to the juvenile fish, hypothesizing that fish fed a more nutritional diet would grow faster. Indeed, fish given pellet food grew significantly faster than those fed the standard brine shrimp diet. After two summers of research we published an article in *Biological Bulletin*. I also presented my work to an audience of scientists at the Marine Biology Laboratory. Today, cultured toadfish are fed pellet food, which, coupled with warmer water temperature, accelerates their growth and facilitates research. I continued to conduct guided independent research with Dr. XXX during the summers through my junior year of college, studying the effectors of fish growth and antibiotic absorption. In addition to my own research I contributed to group efforts, including fish mating studies and long-term mariculture programs. Through my early research I learned to work both independently and as part of a team with common goals.

While at Reed College (Portland, OR), I studied plant diversity and evolution under Dr. XXX. Throughout my senior year of college I worked in Dr. XXX's lab researching my thesis project, for which I received a Howard Hughes Undergraduate Research grant. My research focused on a single nucleotide polymorphism (SNP) found in tandem repeats of the 5.8S ribosomal DNA in two species of the plant *Delphinium* (larkspur). Previous students had been unable to link the SNP with a phenotypic advantage, yet the mutant allele persisted in roughly equal frequency with the wild type allele. I sought to illuminate the mechanism that kept the SNP stable.

I hypothesized that the 5.8S gene family was in the process of concerted evolution. This phenomenon is thought to proceed via two actions: biased gene conversion and/or unequal crossing over. If gene conversion is at work, the total number of tandem repeats will be relatively stable although the allele frequency will change in the direction of bias (thought to be GC, as DNA repair mechanisms are so biased). However, if unequal crossing over is the driving force, the total number of genetic repeats should change as well as the allele frequency. I designed and conducted a set of experiments to determine which was the most likely mechanism and whether the change was occurring during meiosis or mitosis. I observed the changes in polymorphism frequency across three generations of *Delphinium* crosses to investigate meiotic processes. I also surveyed leaf tissue from individual plants over several growth periods to shed light on possible mitotic concerted evolution. For my research I developed a polyacrylamide method to replace the laborious 4% agarose gel protocol that had been used in the lab to genotype plants. In the course of my research I discovered a PCR byproduct that migrated with another DNA fragment in agarose gels but autonomously in acrylamide. By revising my methods I was able to eliminate the byproduct, and so my data were more accurate than those obtained from previous studies.

The Reed College senior thesis comprises a year of independent research culminating in a polished work of writing and an oral defense. Although my research was inconclusive, my undergraduate research taught me to think critically and not to simply accept methods and theories, even when they have been published. In addition, I learned to communicate the basics

of my research to non-scientists, as several of my readers were not biologists. My thesis, entitled "Molecular Concerted Evolution of the 5.8S rDNA Multigene Family in Two Species of *Delphinium*," was the product of this year of research, and is a body of work that continues to give me a great deal of satisfaction. By the time I graduated from college I was even more captivated by molecular biology than I was before I undertook my thesis research.

Shortly after graduating I was hired by the Molecular Profiling department at Biogen Idec (Cambridge, MA), a leading biotechnology company working on therapies for autoimmune diseases such as multiple sclerosis and lupus. At Biogen Idec, I routinely performed tasks such as RNA amplification, Affymetrix microarray hybridization, and Taqman qPCR. The Molecular Profiling lab is a core facility that provides expression assays for the rest of the company. Because of this, independent research is limited; the majority of my time was spent working on other scientists' research and collaborations. However, in an effort to remain cutting-edge, we continually experimented with new techniques, assays, and automation. I was responsible for performing the daily functions necessary for a core lab to produce quality data, as well as for my own projects designed to increase lab productivity. For example, during my tenure at Biogen, Affymetrix introduced a new microarray in plate form that allowed the simultaneous processing of 96 samples, cutting down on labor and cost. However, before we adapted our liquid handlers and workflow to the new microarray, we first had to show that the data it produced were at least as powerful as those from the cartridge type array, which had been in use for several years. We did so in a joint collaboration, and recently published our findings in *Genomics*. The invaluable skills I learned while working at Biogen Idec include proper techniques for handling nucleic acids and automation on various liquid-handling robots, and I was stimulated by being surrounded by a team of motivated scientists who believe that small experiments can make a huge difference in the lives of people affected with debilitating disease.

I am currently a first year graduate student at the University of Wisconsin-Madison in the Cell and Molecular Biology program. This University provides an excellent environment in which to study molecular biology: it is ranked in the top 10 by US News and World Report based on the quality of its research and education, and it is also committed to the "Wisconsin Idea," that the borders of the University are the borders of the state. I have had ample tutoring and teaching training, and have known for several years that I want to continue teaching (see my Personal Statement). My own diverse research experience will serve me well when communicating both with young students and with non-scientists. All students can feel, as I did when I was 14, that science can be a lifelong fascination. I look forward to conducting my own research and presenting it to colleagues in critical forums, as well as participating in Wisconsin outreach programs, such as the Biotechnology Outreach program and the Pre-college enrichment Opportunity Program for Learning Excellence, which offer many opportunities to benefit surrounding communities. I will also take classes through the Delta program (see my Personal Statement), in which I will learn to be a more effective teacher. I hope to have the opportunity to go to local middle and high school classrooms to present hands-on laboratory projects.

Allaire NE, **Rieder LE**, et al. 2008. Experimental comparison and cross-validation of Affymetrix HT plate and cartridge array gene expression platforms. Epub Genomics, Sept 17, 2008.

Rieder, Leila E. "Molecular concerted evolution of the 5.8S rDNA multigene family in two species of *Delphinium*." Thesis, Reed College, 2006.

Rieder, LE and AF Mensinger. 2001. Strategies for increasing growth of juvenile toadfish. Biological Bulletin **201(2)**:283-285.